

U.S. Serial No. 10/743,608
Response to the Office action of May 23, 2005

Changes to the Drawings

The attached sheet of drawings includes prior art legends on FIGS. 1a and 1b.

Remarks

The Objections to the Specification and the Drawings

The Office action objected to the drawings and the specification. Submitted herewith is a replacement sheet of drawings including the required prior art designation on FIGS. 1a and 1b. Additionally, the specification has been amended to correct the noted typographical error. It is respectfully submitted that the foregoing eliminates any objections that may have been proper. Withdrawal of the objections is respectfully requested.

The Rejection Under 35 U.S.C. § 103

The Office action rejected claims 1 and 2 as being unpatentable over Tsau (US 2002/0086492) in view of Huang (US 5874355). It is respectfully submitted that claims 1 and 2 are allowable because (1) an element recited in claim 1 is missing from both Tsau and Huang and (2) there is no motivation for the proposed combination because Tsau teaches away from such a combination.

Claim 1 recites, *inter alia*, depositing a metal layer on a substrate and depositing a titanium nitride (TiN) layer on the metal layer. This is not shown in Tsau. While the Office action correctly and broadly notes that “Tsau teaches depositing a metal stack layer comprising copper or copper alloy with a titanium nitride barrier layer on a substrate,” it is respectfully submitted that Tsau does not disclose that the titanium nitride is deposited on the metal layer. To the contrary, Tsau discloses that a titanium barrier layer may be deposited under each of the metal region 502 and the copper upper plate 1502. That is, the copper layer used for 502 and 1502 may be deposited on titanium nitride. It is respectfully submitted that this is the exact opposite of the relationship recited in claim 1, wherein the titanium nitride layer is deposited on the metal layer.

Furthermore, the cited portions of Huang do not disclose such a relationship between a metal layer and a titanium nitride layer, nor does the Office action contend it does. Thus, it is respectfully submitted that both Tsau and Huang are missing the recited relationship between the metal layer and the titanium nitride layer. Accordingly, no combination of these references can result in the recited relationship. For this reason, it is respectfully submitted that claims 1 and 2 are in condition for allowance.

Additionally, it is well established that the prior art must teach or suggest each of the claim elements and must additionally provide a suggestion of, or an incentive for, the claimed combination of elements to establish a *prima facie* case of obviousness. See *In re Oetiker*, 24 USPQ. 2d 1443, 1446 (Fed. Cir. 1992); *Ex parte Clapp*, 227 USPQ. 972, 973 (Bd. Pat. App. 1985); *In re Royka*, 490 F.2d 981 (CCPA 1974) and M.P.E.P. § 2143. It is also well settled that it is improper to combine references where the references teach away from their combination. *In re Grasselli*, 218 USPQ. 769, 779 (Fed. Cir. 1983).

In the case at hand, the Office action admits that Tsau does not show the use of tungsten as the metal for the upper plate of the contact interconnect. The Office action then looks to Huang to cure this deficiency by noting that Huang teaches the use of tungsten in the metallization of a semiconductor device. As motivation for this combination, the Office action contends that it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the tungsten metallization of Huang ... in the capacitor device of Tsau because tungsten is a conventional metal to use in interconnect metallization due to its compatibility with damascene CMP processes, good conductivity, and high melting point.

Tsau indicates that historically CMOS metal-insulator-metal capacitors have used aluminum interconnects, but that copper interconnects are replacing aluminum interconnects as integration density increases. (Tsau, [0005]). Tsau further indicates that the capacitors made according to the Tsau invention are specifically designed for use in copper dual-damascene processing and are CMOS compatible. (Tsau, [0007]). To that end, Tsau discloses the use of copper interconnects to be compatible with CMOS logic processing. Thus, the selection of copper interconnects in Tsau is purposeful to result in CMOS compatibility.

It is respectfully submitted that Tsau teaches away from the very combination that the Office action makes. Tsau focuses on creation of CMOS metal-insulator-metal capacitors having copper interconnects and emphasizes the importance of copper dual-damascene compatibility. The fact that Tsau discloses the importance of the interconnects being copper counsels against the suggested substitution of tungsten for the copper layer. In fact, Tsau teaches away from using interconnects that are other than copper because substitute interconnects would not be compatible with CMOS logic processing. It is not clear what

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affect will result from changing from copper to tungsten. Such a change may render Tsau unfit for its intended purpose of being CMOS logic process compatible. It cannot be fairly said that tungsten is a ready substitute for copper when the disclosure of Tsau extols the virtues of copper interconnects.

The disclosures of both Tsau and Huang are deficient with regard to disclosing titanium nitride being deposited on a metal layer. Further, there is no motivation for the modification of Tsau to include tungsten according to the disclosure of Huang. Because all claim elements have not been identified and because no motivation exists for the proposed modification, it is respectfully submitted that a *prima facie* case of obviousness has not been made. The applicant respectfully requests a favorable reconsideration on the merits.

Conclusion

Reconsideration of the application and allowance thereof are respectfully requested. If there is any matter that the examiner would like to discuss, the examiner is invited to contact the undersigned representative at the telephone number set forth below.

Respectfully submitted,

HANLEY, FLIGHT & ZIMMERMAN, LLC
20 North Wacker Drive
Suite 4220
Chicago, Illinois 60606



Mark C. Zimmerman
Reg. No. 44,006
Attorney for Applicants
312.580.1020

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